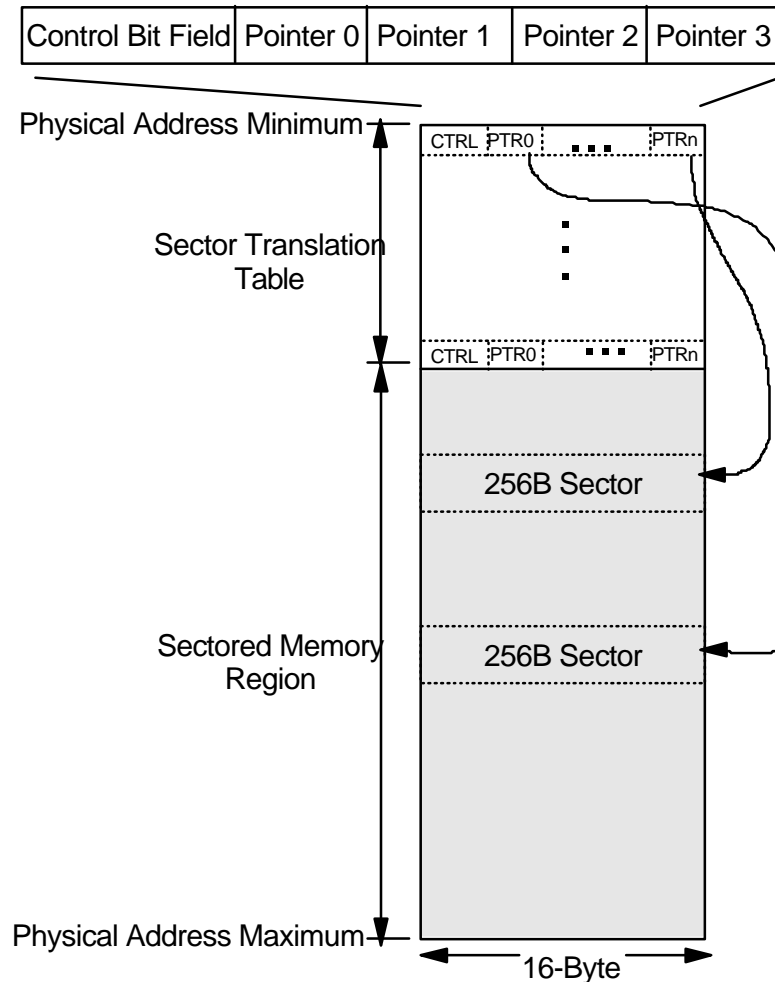


ServerSet III and MXT Technology

Sectored Memory Management



- Indirect "virtual" mapping of main memory

- Multi-step access to reference data:

1. Access Translation Table Entry, decode and parse sector addresses
2. Access data from sector
3. Update Translation Table Entry if changes

- Sector Translation Table

- Direct mapped 16B entry, per 1KB real memory block (size = real memory / 1KB * 16)
- Uncompressed entries encoded with flags and up to 4 address pointers to 256B sectors for storing data, associated with a 1KB block, but less than 121 bits
- Compressed entries encoded to contain actual compressed data when less than 121 bits (64:1 compression)

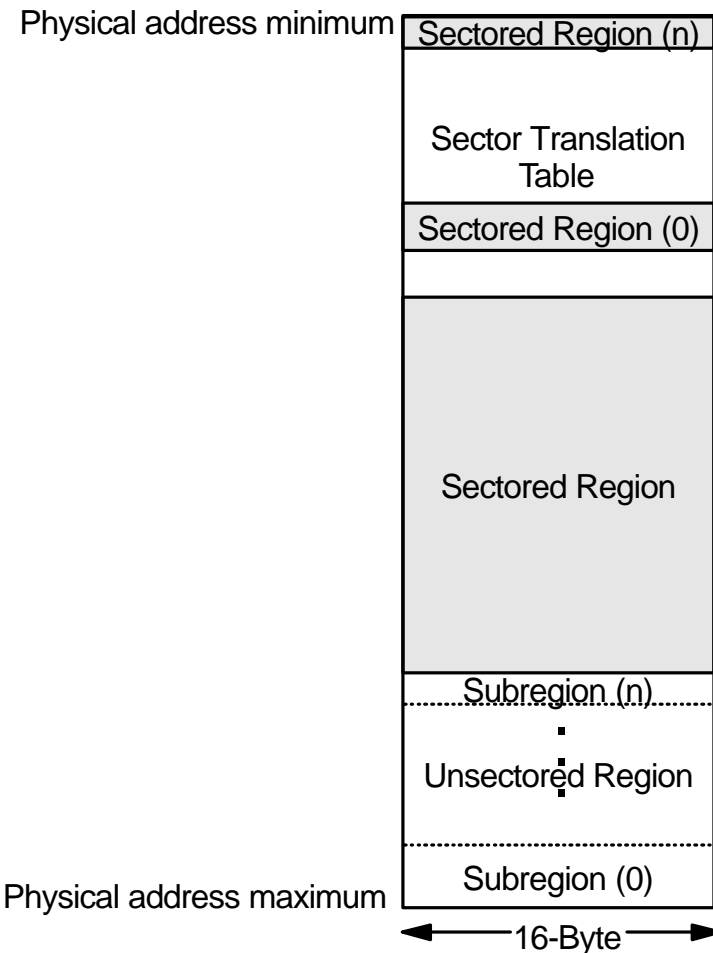
- Sectored Region

- Memory contains a "sea" of 256B sector stored as a linked list.
- List address pointers exist in unused sectors (i.e., as sectors are consumed, the linked list shrinks)
- Sectors may be shared by adjacent block data to reduce fragmentation.



ServerSet III and MXT Technology

Unsectored Memory Management

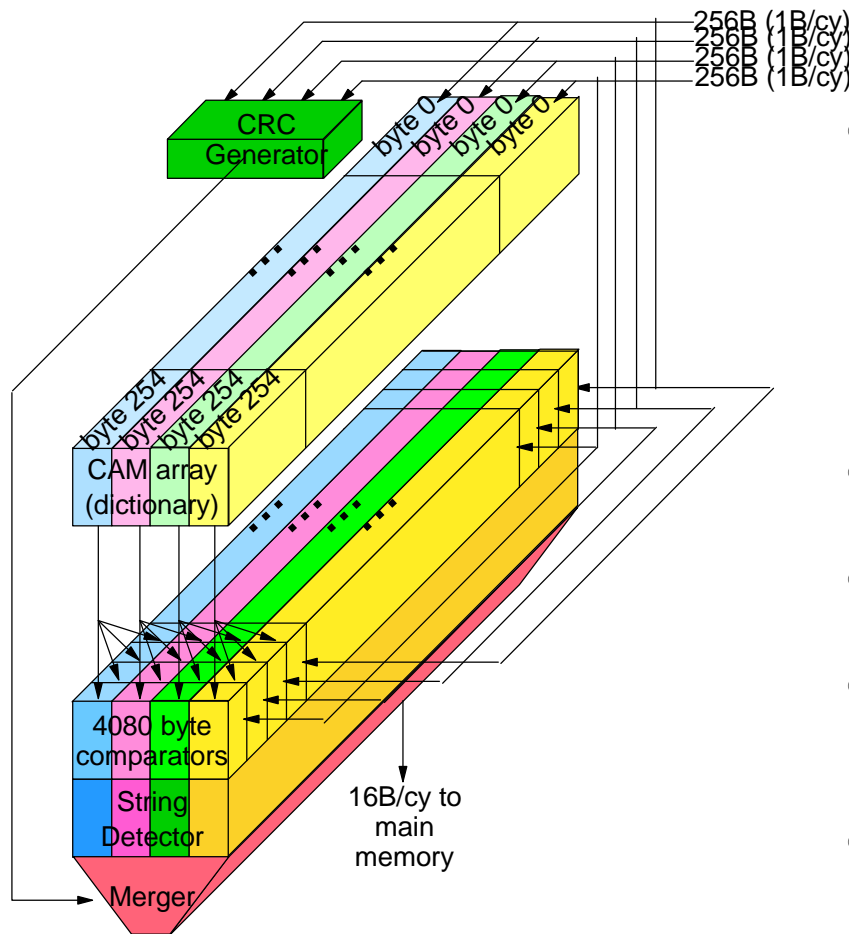


- **Direct mapping of main memory**
 - Requires one-step access to reference data:
 1. Access data from relocated direct mapped data address.
 - Lowest latency access to performance sensitive data structures.
- **Sector Translation Table**
 - Unused "holes" in table are redefined as sectored memory to eliminate wasted space.
- **Un-Sectored Region**
 - Selectable as 0-4 independent regions (32KB - 256MB) beginning at 32KB aligned addresses.
 - Contain only uncompressed data.



ServerSet III and MXT Technology

Compression Technology



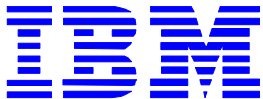
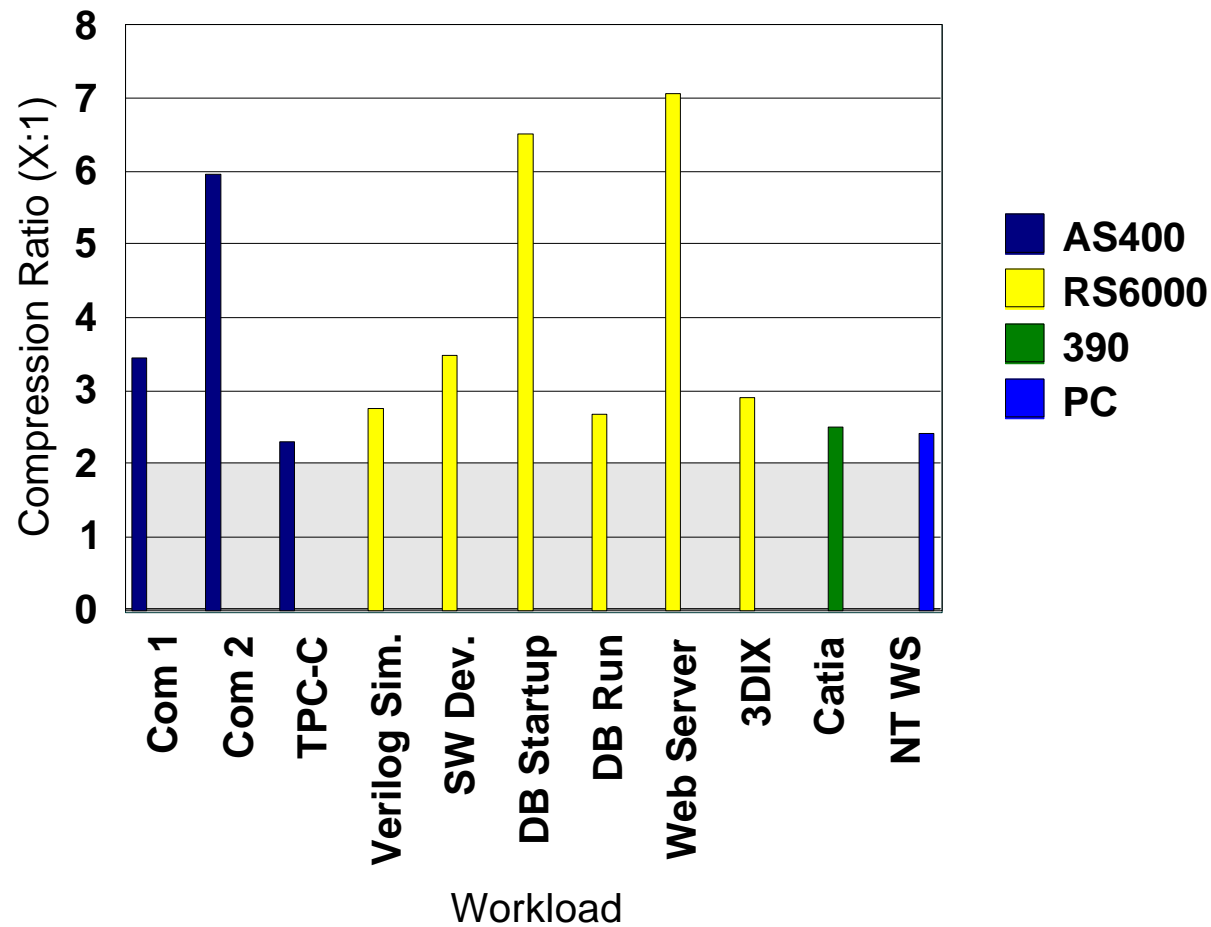
- Variation of Ziv-Lempel algorithm (LZ77 or LZ1) modified for parallel single pass loss-less compression.
- Compresses replicate strings of 2 or more bytes or "raw" characters within 1KB block yielding 1:1 - 64:1 compression ratio.
 - Raw character = (0, databyte)
 - String = (1, primary len, position, secondary len)
 - Encoded length (2-12 bit) and position (2-10-bit)
 - CRC-32 protected compressed block
- Each of four engines compress one byte/cycle of a 1/4 block (256B).
- Four dictionaries are incrementally filled and compared to new byte every cycle.
- Emerging strings may occur within any dictionary and are tracked for the longest occurrence.
- Strings are encoded and packed into an output buffer with CRC-32 appended to the end of the buffer when complete.



ServerWorks

ServerSet III and MXT Technology

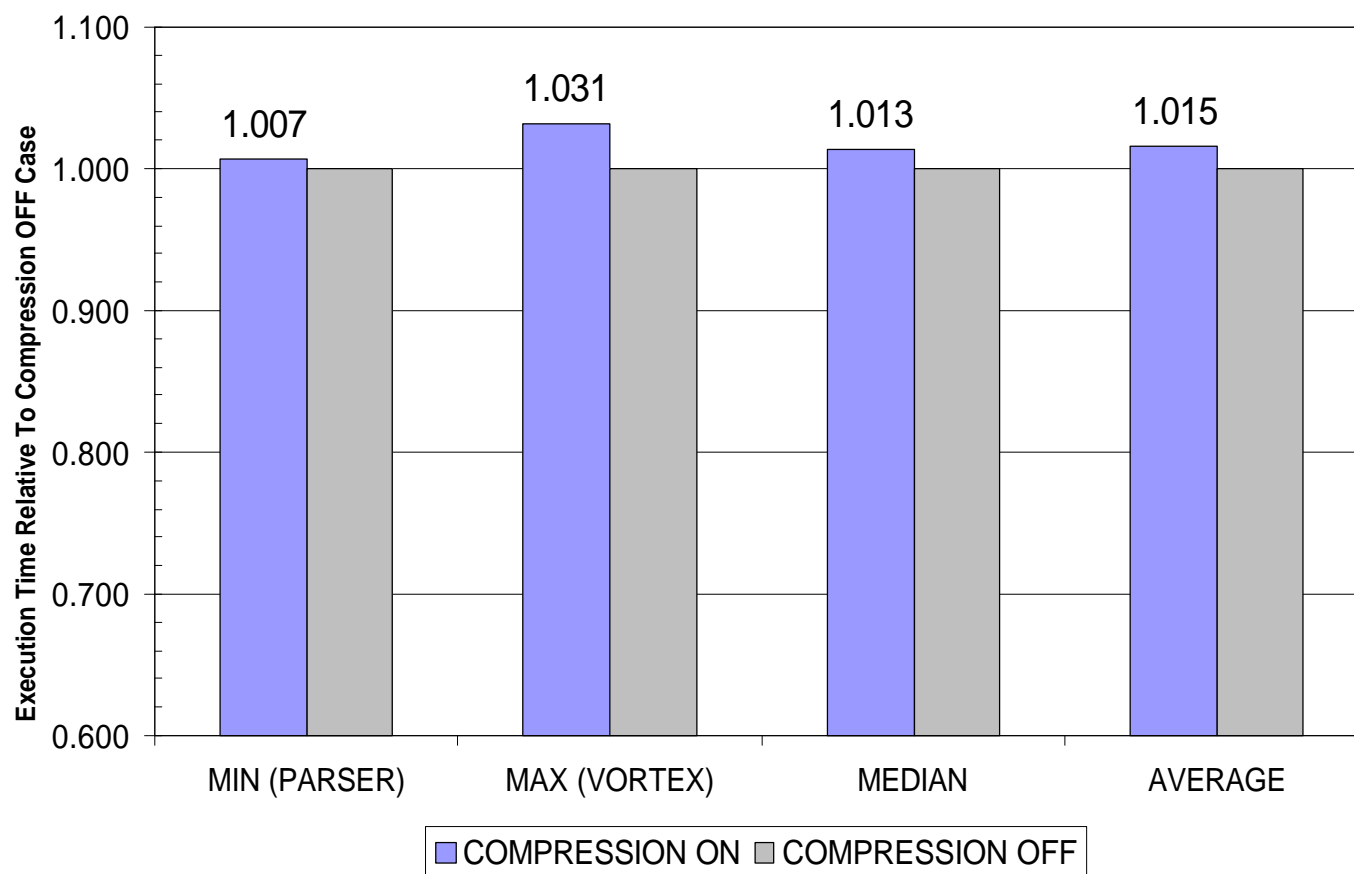
Real-World Compression



ServerSet III and MXT Technology

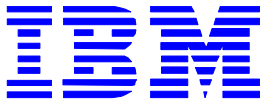
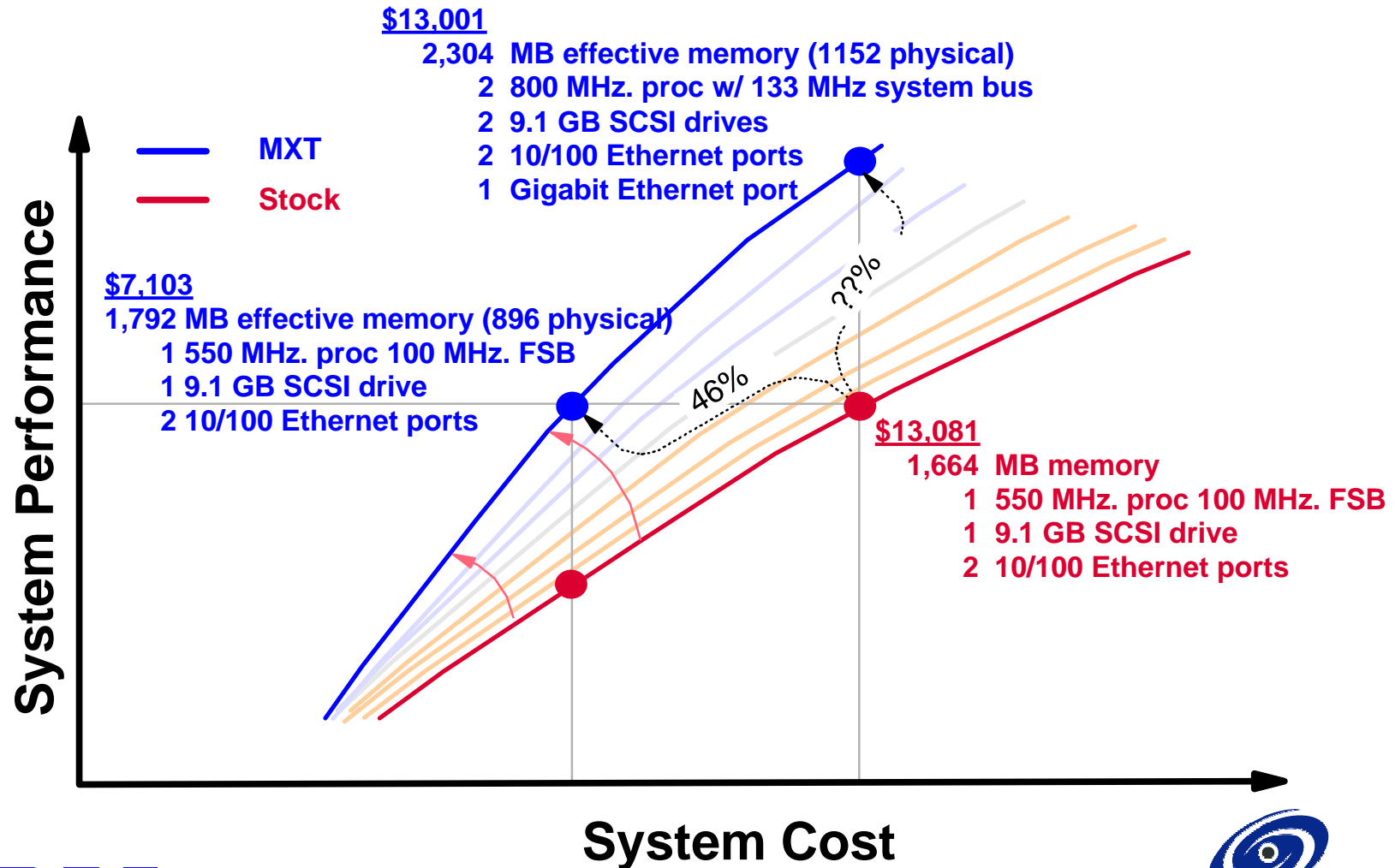
Performance Overhead for SPEC CINT2000 Benchmarks

Intel XEON (256K L2), 512MB System



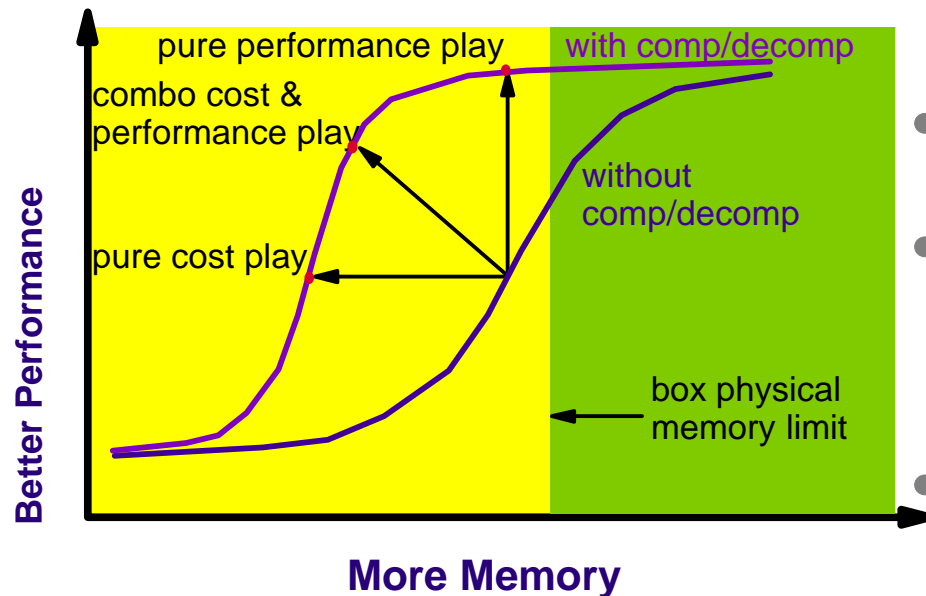
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System Cost Leverage



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Conclusion



- Proven technology that empowers consumers to efficiently utilize their memory investment.
- Logical step in the pervasion of ubiquitous compression techniques.
- IT professionals routinely experience \$1000's on systems ranging from High density servers to large memory enterprise servers
- Technology well suited to other memory intensive applications too (disk controllers, laptops, etc.)

